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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/606,597	**Applicant(s)** POLLOCK ET AL.	
	Examiner SHENG-JEN TSAI	**Art Unit** 2186	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 January 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is taken in response to Applicants' Amendments and Remarks filed on January 14, 2008 regarding application 10/606,597 filed on 6/26/2003.

2. Claims 1-6 and 8-9 have been amended.

Claims 11-18 have been added.

Claims 1-18 are pending for consideration.

3. ***Response to Remarks and Amendments***

Applicants' remarks have been fully and carefully considered with examiner's response set forth below.

(1) In view of amendment on claim 9, objection of claim 9 has been withdrawn.

(2) Applicants amend claim 1 to recite "first adjusted seek length" and "second adjusted seek length," and contend that the Heath reference fails to teach adjusting the seek length. The Examiner disagrees.

First, Applicants readily admit that "Heath describes a method that takes both <u>the raw (i.e., unadjusted) seek length</u> as well as <u>the rotational latency of the seek</u> into account in determining an order of command execution [see page 2, 4th paragraph of Applicants' Remark filed on 1/14/1008]. Thus, the "<u>effective seek length</u>" based on which the decision is made is derived by <u>adjusting the raw/unadjusted seek length</u> with the consideration of <u>the rotational latency of the seek</u>.

Second, Heath illustrates and explains that the <u>rotational latency of the seek</u> is defined by the radial length [figure 1, 18] that the read/write element [figure 1, 12] can traverse within one revolution along the cylinder path [figure 1, 14; column 3, line 49 to

column 4, line 24]. Specifically the “shaded area” shown in figures 1, 2 and 3 defines a “seek range” [e.g., figure 1, 16] that the read/write element can traverse within one revolution along the cylinder path.

Third, Heath’s method of reducing rotational latency [Method for Reducing Rotational latency in a Disc Drive (title)] is directed to select a command with a destination that has a smallest rotational latency from the current position of the read/write element within the seek range [column 4, lines 25-35]. Thus, destinations that are in the immediate neighborhood of position X1 [figure 1] but outside the shaded area (referred to as out-X1) may have smaller raw seek lengths than those destinations in the immediate neighborhood of position X3 [figure 1] but inside the shaded area (referred to as in-X3); the read/write element can not each within one revolution those out-X1 destinations but is able to reach within one revolution those in-X3 destinations [explained in details in col. 3 line 49 to col. line 24]. As such, in-X3 destinations are selected over out-X1 destinations even though out-X1 destinations have smaller seek lengths. In other words, in-X3 destinations have smaller adjusted seek lengths than out-X1 destinations when the rotational latency of the seek is taken into consideration.

Thus, Heath clearly teaches adjusting raw/unadjusted seek lengths by taking into consideration the rotational latency of the seek.

Another iteration of claim analysis based on the Heath reference has been made. Refer to the corresponding sections of the following claim analysis for details.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claim 18 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 18 recites the limitation of "the method of claim 17, wherein at least another of the terms of the arithmetic combination comprises an exponential function of the destination cylinder." However, the Examiner was not able to identify or locate any support of written description of this limitation in the specification of the application. As such, this limitation lacks the support of the written description and should be removed.

6. ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-4 and 6-10 are rejected under 35 U.S.C. 102(b) as being anticipated by Heath et al. (US 5,570,332, hereinafter referred to as Heath).

It is noted that, in the following claim analysis, those elements recited by the claims are presented using **bold** font.

As to claim 1, Heath discloses **a method** [Method for Reducing Rotational latency in a Disc Drive (title); abstract] **comprising a step (a) of selecting a target destination from among first and second target destinations** [each command of the command queue represents a target destination, and any two commands may be the first and second target destinations -- A command queue array is searched for a command that addresses a location (i.e., the target destination) within a range of cylinders determined by the number of cylinders in the discrete angular region having the smallest rotational latency. Finally, the command addressing a location in the range of cylinders in the selected discrete angular region of the medium is executed (abstract); figures 4A~4B and figures 6A~6C illustrate the process of selecting a target destination; A command queue array is searched for a command that addresses a location within a range of cylinders in the discrete angular region having the smallest rotational latency (column 3, lines 16-20)] **using at least two adjusted seek lengths including a first adjusted seek length for the first target destination and a second adjusted seek length for the second target destination** [the "effective seek length" based on which the decision is made is derived by adjusting the raw/unadjusted seek length with the consideration of the rotational latency of the seek -- Heath illustrates and explains that the rotational latency of the seek is defined by the radial length (figure 1, 18) that the read/write element (figure 1, 12) can traverse within one revolution along the cylinder path (figure 1, 14; column 3, line 49 to column 4, line 24). Specifically the "shaded area" shown in figures 1, 2 and 3 defines a "seek range" (e.g., figure 1, 16) that the read/write element can traverse within one revolution along the cylinder path. Further, Heath's

method of reducing rotational latency (Method for Reducing Rotational latency in a Disc Drive (title)) is directed to select a command with a destination that has a smallest rotational latency from the current position of the read/write element within the seek range (column 4, lines 25-35). Thus, destinations that are in the immediate neighborhood of position X1 (figure 1) but outside the shaded area (referred to as out-X1, <u>the first target destination</u>) may have smaller raw seek lengths than those destinations in the immediate neighborhood of position X3 (figure 1) but inside the shaded area (referred to as in-X3, <u>the second target destination</u>); the read/write element can not each within one revolution those out-X1 destinations but is able to reach within one revolution those in-X3 destinations (explained in details in col. 3 line 49 to col. line 24). As such, in-X3 destinations are selected over out-X1 destinations even though out-X1 destinations have smaller seek lengths. In other words, in-X3 destinations have smaller adjusted seek lengths than out-X1 destinations when the rotational latency of the seek is taken into consideration] **wherein each of the first and second adjusted seek lengths are adjusted using respective lateral offset indicators** [the corresponding lateral offset indicator is the "<u>seek range</u>" (Seek range 16 has <u>a radial length</u> 18 which defines the maximum number of cylinders that may be accessed on either side of cylinder path 14 at a selected angular distance from the present location of read/write element 12. Accordingly, seek range 16 represents the maximum area of disc 10 which may be accessed by read/write element 12 during a substantially complete revolution of disc 10 (column 3, lines 60-67)] **derived from a longitudinal position measurement of a source head at a source location** [figures 1-3 show the

longitudinal position measurement (the shaded area) and how the seek range is derived from various positions along the cylinder path of the longitudinal position (figure 1, 14); column 3, line 49 to column 4, line 25].

As to claim 2, Heath teaches that **the method of claim 1 in which the selecting step (a) includes steps of:**

(a1) estimating several preliminary seek lengths each corresponding to a queued command, a first one of the estimated preliminary seek lengths comprising the first adjusted seek length [figure 6B shows that there are a plurality of commands in the command queue (the total number of commands in the queue is denoted as INDEX, see steps 118 and 120), and the <u>seek distance</u> as well as the <u>seek time</u> of each command are calculated (step 99 and 102, respectively), which results in several seek distances (exactly INDEX number of seek distances); note that the "seek distance" is the corresponding one of the lateral seek cost indicators as explained in "As to claim 1; " destinations that are in the immediate neighborhood of position X1 (figure 1) but outside the shaded area (referred to as out-X1, <u>the first target destination</u>) may have smaller raw seek lengths than those destinations in the immediate neighborhood of position X3 (figure 1) but inside the shaded area (referred to as in-X3, <u>the second target destination</u>); the read/write element can not each within one revolution those out-X1 destinations but is able to reach within one revolution those in-X3 destinations (explained in details in col. 3 line 49 to col. line 24). As such, in-X3 destinations are selected over out-X1 destinations even though out-X1 destinations have smaller seek lengths. In other words, in-X3 destinations have smaller adjusted

seek lengths than out-X1 destinations when the rotational latency of the seek is taken into consideration];

(a2) determining that the first adjusted seek length corresponds to one of the queued commands that refers to a non-ideal target, the non-ideal target not being reliably reachable within a one-cycle delay [step 106, figure 6B determines if the seek time of a command is greater than or less than the criterion (step 98 specifies that the criterion is one RP (Revolution Period)), if it is greater than the criterion, then it means it can not be reached in one cycle, hence a non-ideal target; In other words, some bins may contain only command addresses that can only be accessed in two revolutions (i.e., cycles) (column 2, lines 28-30); destinations that are in the immediate neighborhood of position X1 (figure 1) but outside the shaded area (referred to as out-X1, <u>the first target destination</u>) may have smaller raw seek lengths than those destinations in the immediate neighborhood of position X3 (figure 1) but inside the shaded area (referred to as in-X3, <u>the second target destination</u>); the read/write element can not each within one revolution those out-X1 destinations but is able to reach within one revolution those in-X3 destinations (explained in details in col. 3 line 49 to col. line 24). As such, in-X3 destinations are selected over out-X1 destinations even though out-X1 destinations have smaller seek lengths. In other words, in-X3 destinations have smaller adjusted seek lengths than out-X1 destinations when the rotational latency of the seek is taken into consideration]; **and**

(a3) selecting another of the queued commands to be executed immediately so that the selected command refers to the second target destination, the second

target destination being reliably reachable within a partial cycle delay [step 106, figure 6B determines if the seek time of a command is greater than or less than the criterion (step 98 specifies that the criterion is one RP (Revolution Period)), if it is less than the criterion, then the command is selected for execution (step 108); When disc 10 is divided into discrete angular regions having variable boundary lines as illustrated in FIG. 2, read/write element 12 must cross at least approximately one angular region (<u>1/10th of a revolution</u>) before reaching boundary line 22B and the discrete angular region having relative angular region number N=1 (region 20B). Similarly, read/write element 12 must cross at least approximately two angular regions (<u>2/10ths of a revolution</u>) before reaching boundary line 22C and the discrete angular region having a relative angular region number N=2. Thus, each discrete angular region 20A-20J is assigned a rotational latency value of <u>N/10ths of a revolution</u>, where N=the region's angular region number N (column 5, lines 35-46); destinations that are in the immediate neighborhood of position X1 (figure 1) but outside the shaded area (referred to as out-X1, <u>the first target destination</u>) may have smaller raw seek lengths than those destinations in the immediate neighborhood of position X3 (figure 1) but inside the shaded area (referred to as in-X3, <u>the second target destination</u>); the read/write element can not each within one revolution those out-X1 destinations but is able to reach within one revolution those in-X3 destinations (explained in details in col. 3 line 49 to col. line 24). As such, in-X3 destinations are selected over out-X1 destinations even though out-X1 destinations have smaller seek lengths. In other words, in-X3

destinations have smaller adjusted seek lengths than out-X1 destinations when the rotational latency of the seek is taken into consideration].

As to claim 3, Heath teaches that **the method of claim 1 in which the selecting step (a) includes a step (a1) of deriving an adjusted seek length for each one of several queued commands, two of the several adjusted seek lengths being the first and second adjusted seek lengths** [figure 6B shows that there are a plurality of commands in the command queue (the total number of commands in the queue is denoted as INDEX, see steps 118 and 120), and the <u>seek distance</u> as well as the <u>seek time</u> of each command are calculated (step 99 and 102, respectively), which results in several seek distances (exactly INDEX number of seek distances); note that the “seek distance” is the corresponding one of the lateral seek cost indicators, and the seek time is the second of the lateral seek cost indicators, as explained in “As to claim 1;” destinations that are in the immediate neighborhood of position X1 (figure 1) but outside the shaded area (referred to as out-X1, <u>the first target destination</u>) may have smaller raw seek lengths than those destinations in the immediate neighborhood of position X3 (figure 1) but inside the shaded area (referred to as in-X3, <u>the second target destination</u>); the read/write element can not each within one revolution those out-X1 destinations but is able to reach within one revolution those in-X3 destinations (explained in details in col. 3 line 49 to col. line 24). As such, in-X3 destinations are selected over out-X1 destinations even though out-X1 destinations have smaller seek lengths. In other words, in-X3 destinations have smaller adjusted seek lengths than out-X1 destinations when the rotational latency of the seek is taken into consideration].

As to claim 4, Heath teaches that **the method of claim 1 in which the selecting step (a) includes a step (a1) of obtaining the longitudinal position measurement as a scalar value using the source head** [figure 1, 12 shows the source head (read/write element); figures 1-3 show that the lateral offset along the longitudinal path is derived and calibrated by a model which divides the disk into a plurality of discrete angular regions, and for each region, a number of cylinders that may be traversed by the data retrieval element during a single revolution is identified (abstract); column 3, line 49 to column 6, line 65; figure 4B, steps 71 and 72 show that this longitudinal position measurement is calculated as a scalar value denoted as “Cylinder Delta;” figure 6B, step 99 shows that this value is further calculated as a scalar value of “seek distance “ (step 99) and a scalar value of “seek time” (step 102)] **wherein the source head cannot access the first or second target destination** [figure 6B, steps 106, 118 and 120 illustrate the case where the target destination cannot be reached within the criterion from the current position of the read/write element; while steps 106, 108 and 110 illustrate the case where the target destination can be reached within the criterion from the current position of the read/write element].

As to claim 6, Heath teaches that **the method of claim 1 in which the selecting step (a) includes steps of:**

(a1) determining a source cylinder identifier [Each disc has a plurality of concentric <u>tracks</u>, ... In addition, each track is further divided into a plurality of <u>sectors</u>. A track <u>cylinder</u> is formed by the radically corresponding tracks on the disc memories. In a disc drive system, a disc rotates at a high speed while the read/write element "flies"

over the surface of the rotating disc. The read/write element is positioned over specific areas or sectors of the disc in accordance with commands received from the host compute (column 1, lines 12-22); The seek time is the time required for the read/write element to radically move across or traverse cylinders between the present cylinder over which the read/write element is positioned and the cylinder to be addressed by the particular command (column 1, lines 31-35)], **a source head identifier** [For purposes of sorting the command queue, the command addresses are converted into a cylinder, head and angular region address. The angular regions provide a common system of measurement for all addresses regardless of recording zone (column 5, lines 10-14)], **and a source sector identifier for the source head** [Each disc has a plurality of concentric tracks, ... In addition, each track is further divided into a plurality of sectors. A track cylinder is formed by the radically corresponding tracks on the disc memories ... The read/write element is positioned over specific areas or sectors of the disc in accordance with commands received from the host compute (column 1, lines 12-22); The seek time is the time required for the read/write element to radically move across or traverse cylinders between the present cylinder over which the read/write element is positioned and the cylinder to be addressed by the particular command (column 1, lines 31-35)], **the source sector identifier being the longitudinal position measurement** [figures 1-3 show that the lateral offset along the longitudinal path is derived and calibrated by a model which divides the disk into a plurality of discrete angular regions, and for each region, a number of cylinders that may be traversed by

the data retrieval element during a single revolution is identified (abstract); column 3, line 49 to column 6, line 65];

(a2) receiving many queued commands [A command queue array is searched for a command that addresses a location (i.e., the target destination) within a range of cylinders determined by the number of cylinders in the discrete angular region having the smallest rotational latency. Finally, the command addressing a location in the range of cylinders in the selected discrete angular region of the medium is executed (abstract); Modern disc drives can have up to 64 or more commands in the command queue (column 1, lines 56-57)] **that each includes a target cylinder identifier** [Each disc has a plurality of concentric tracks, ... In addition, each track is further divided into a plurality of sectors. A track cylinder is formed by the radically corresponding tracks on the disc memories. In a disc drive system, a disc rotates at a high speed while the read/write element "flies" over the surface of the rotating disc. The read/write element is positioned over specific areas or sectors of the disc in accordance with commands received from the host compute (column 1, lines 12-22); The seek time is the time required for the read/write element to radically move across or traverse cylinders between the present cylinder over which the read/write element is positioned and the cylinder to be addressed by the particular command (column 1, lines 31-35)], **a target head identifier** [For purposes of sorting the command queue, the command addresses are converted into a cylinder, head and angular region address. The angular regions provide a common system of measurement for all addresses regardless of recording zone (column 5, lines 10-14)], a**nd a target sector identifier** [Each disc has a plurality

of concentric tracks, ... In addition, each track is further divided into a plurality of sectors. A track cylinder is formed by the radically corresponding tracks on the disc memories ... The read/write element is positioned over specific areas or sectors of the disc in accordance with commands received from the host compute (column 1, lines 12-22)];

(a3) computing a difference between the source cylinder identifier of the determining step (a1) and each of the target cylinder identifiers so as to obtain a preliminary seek length corresponding to each of the queued commands of the receiving step

(a2) [figures 4A~4B and figures 6A~6C illustrate the process of selecting a target destination; A command queue array is searched for a command that addresses a location within a range of cylinders in the discrete angular region having the smallest rotational latency (column 3, lines 16-20)] ;

(a4) identifying at least two of the queued commands of the receiving step (a2), the preliminary seek length corresponding to each of the identified commands being smaller that a predetermined threshold [the corresponding “at least two lateral seek cost indicators” are (1) the “seek distance” (If the logical block address of command queue (index) falls within the parameters which define angular region N modulo 10, the "cylinder delta", otherwise known as a "seek distance," is computed in step 71 (column 8, lines 52-55); D=the identified seek distance traversed by the data retrieval element for a command (column 10, lines 49-50); figure 6B, step 99, identify seek distance, D, of command in queue), and (2) the “seek time” (figure 6B, step 102,

compute seek time; Preferably, the method of the present invention estimates seek times by computing seek times for longer seeks in the linear region 78 of the seek profile according to the relationship: (column 10, lines 40-60); figure 6B, step 106 shows the comparison to a threshold (criterion, figure 6B, step 98)];

(a5) adjusting the seek length corresponding to each of the identified commands of the identifying step (a4), the adjustments each being partly based on the corresponding identified command's target head identifier, on the source head identifier, and on the source sector identifier, the adjustments being the lateral offset indicators, the adjusted seek lengths including the first and second adjusted seek lengths [figures 4A~4B and 6A~6B; column 10, line 26 to column 17, line 35; destinations that are in the immediate neighborhood of position X1 (figure 1) but outside the shaded area (referred to as out-X1, <u>the first target destination</u>) may have smaller raw seek lengths than those destinations in the immediate neighborhood of position X3 (figure 1) but inside the shaded area (referred to as in-X3, <u>the second target destination</u>); the read/write element can not each within one revolution those out-X1 destinations but is able to reach within one revolution those in-X3 destinations (explained in details in col. 3 line 49 to col. line 24). As such, in-X3 destinations are selected over out-X1 destinations even though out-X1 destinations have smaller seek lengths. In other words, in-X3 destinations have smaller adjusted seek lengths than out-X1 destinations when the rotational latency of the seek is taken into consideration];

(a6) deriving several latency indicators each corresponding to one of the queued commands of the receiving step (a2), each of the latency indicators based on the

corresponding command's target sector identifier and seek length, at least two of the several latency indicators based on the adjusted seek lengths of the adjusting step (a5) [the corresponding latency indicators are the “seek distance” and the “seek time” as explained above; The present invention is a method for decreasing rotational latency in systems which include a data retrieval element and a rotating medium. The method requires that the rotating medium be divided into a plurality of discrete angular regions. For each discrete angular region, a number of cylinders that may be traversed by the data retrieval element during a single revolution of the medium is identified. A rotational latency is assigned to each discrete angular region based on a current location of the retrieval element. A command queue array is searched for a command that addresses a location within a range of cylinders in the discrete angular region having the smallest rotational latency. Finally, the command addressing a location in the range of cylinders in the selected discrete angular region of the medium is executed (column 3, lines 8-22)]; **and**

(a7) executing one of the queued commands of the receiving step (a2) selected based on the latency indicators of the deriving step (a6), using as the target destination the selected command's target cylinder identifier, the selected command's target head identifier, and the selected command's target sector identifier [The present invention is a method for decreasing rotational latency in systems which include a data retrieval element and a rotating medium. The method requires that the rotating medium be divided into a plurality of discrete angular regions. For each discrete angular region, a number of cylinders that may be traversed by the

data retrieval element during a single revolution of the medium is identified. A rotational latency is assigned to each discrete angular region based on a current location of the retrieval element. A command queue array is searched for a command that addresses a location within a range of cylinders in the discrete angular region having the smallest rotational latency. <u>Finally, the command addressing a location in the range of cylinders in the selected discrete angular region of the medium is executed</u> (column 3, lines 8-22); The seek time is the time required for the read/write element to radically move across or traverse cylinders between <u>the present cylinder over which the read/write element is positioned</u> and <u>the cylinder to be addressed by the particular command</u> (column 1, lines 31-35)].

As to claim 7, Heath teaches that **the method of claim 1 in which the selecting step (a) includes steps of**:

(a1) positioning a disc stack rigidly supporting at least two pre-written data storage discs into a disc drive [Rotating disc memories include <u>one or more discs driven about a spindle axis</u> … (column 1, lines 11-22); figures 1-3] **so that the target destination is a storage location on one of the data storage discs** [In a disc drive system, a disc rotates at a high speed while the read/write element "flies" over the surface of the rotating disc. The read/write element is positioned over specific areas or sectors of the disc in accordance with commands received from the host compute (column 1, lines 12-22); The seek time is the time required for the read/write element to radically move across or traverse cylinders between <u>the present cylinder</u> over which

the read/write element is positioned and <u>the cylinder to be addressed by the particular command</u> (column 1, lines 31-35)]; **and**

(a2) deriving a calibrated offset model that defines how the longitudinal position measurement affects the lateral offset indicators [figures 1-3 show that the lateral offset along the longitudinal path is derived and calibrated by a model which divides the disk into a plurality of discrete angular regions, and for each region, a number of cylinders that may be traversed by the data retrieval element during a single revolution is identified (abstract); column 3, line 49 to column 6, line 65].

As to claim 8, Heath teaches **an apparatus including: a disc stack having at least one rotatable data storage discs including as least two data storage surfaces** [Rotating disc memories include <u>one or more discs driven about a spindle axis</u> … (column 1, lines 11-22); figures 1-3]; **and**

a controller configured to select a target destination on one of the data storage surfaces from from among first and second target destinations [each command of the command queue represents a target destination, and any two commands may be the first and second target destinations -- A command queue array is searched for a command that <u>addresses a location</u> (i.e., the target destination) within a range of cylinders determined by the number of cylinders in the discrete angular region having the smallest rotational latency. Finally, the command addressing a location in the range of cylinders in the selected discrete angular region of the medium is executed (abstract); figures 4A~4B and figures 6A~6C illustrate the process of selecting a target destination; A command queue array is searched for a command that addresses a

location within a range of cylinders in the discrete angular region having the smallest rotational latency (column 3, lines 16-20)] **using at least two adjusted seek lengths including a first adjusted seek length for the first target destination and a second adjusted seek length for the second target destination** [the "<u>effective seek length</u>" based on which the decision is made is derived by <u>adjusting the raw/unadjusted seek length</u> with the consideration of <u>the rotational latency of the seek</u> -- Heath illustrates and explains that the <u>rotational latency of the seek</u> is defined by the radial length (figure 1, 18) that the read/write element (figure 1, 12) can traverse within one revolution along the cylinder path (figure 1, 14; column 3, line 49 to column 4, line 24). Specifically the "shaded area" shown in figures 1, 2 and 3 defines a "seek range" (e.g., figure 1, 16) that the read/write element can traverse within one revolution along the cylinder path. Further, Heath's method of reducing rotational latency (Method for Reducing Rotational latency in a Disc Drive (title)) is directed to select a command with a destination that has a smallest rotational latency from the current position of the read/write element within the seek range (column 4, lines 25-35). Thus, destinations that are in the immediate neighborhood of position X1 (figure 1) but outside the shaded area (referred to as out-X1, <u>the first target destination</u>) may have smaller raw seek lengths than those destinations in the immediate neighborhood of position X3 (figure 1) but inside the shaded area (referred to as in-X3, <u>the second target destination</u>); the read/write element can not each within one revolution those out-X1 destinations but is able to reach within one revolution those in-X3 destinations (explained in details in col. 3 line 49 to col. line 24). As such, in-X3 destinations are selected over out-X1

destinations even though out-X1 destinations have smaller seek lengths. In other words, in-X3 destinations have smaller adjusted seek lengths than out-X1 destinations when the rotational latency of the seek is taken into consideration] **wherein each of the first and second adjusted seek lengths are adjusted using respective lateral offset indicators** [the corresponding lateral offset indicator is the "seek range" (Seek range 16 has a radial length 18 which defines the maximum number of cylinders that may be accessed on either side of cylinder path 14 at a selected angular distance from the present location of read/write element 12. Accordingly, seek range 16 represents the maximum area of disc 10 which may be accessed by read/write element 12 during a substantially complete revolution of disc 10 (column 3, lines 60-67)] **derived from a longitudinal position measurement of a source head at a source location** [figures 1-3 show the longitudinal position measurement (the shaded area) and how the seek range is derived from various positions along the cylinder path of the longitudinal position (figure 1, 14); column 3, line 49 to column 4, line 25].

As to claim 9, Heath teaches that **the apparatus of claim 8, further including: a target head** [A command queue array is searched for a command that addresses a location within a range of cylinders in the discrete angular region having the smallest rotational latency (column 3, lines 16-22); each command specifies a target head (For purposes of sorting the command queue, the command addresses are converted into a cylinder, head and angular region address. The angular regions provide a common system of measurement for all addresses regardless of recording zone (column 5, lines 10-14))] **able to access the target destination** [figure 6B, steps 106, 108 and 110

illustrate the case where the target destination can be reached within the criterion from the current position of the read/write element] **but not able to access a source location** [the longitudinal position measurements are generated based on the "current position" (i.e., the source position) of the read/write element instead of by the target head information in the command -- The cylinder delta is the number of cylinders from <u>the current position of the read/write element</u> to the start cylinder of command queue (index) (column 8, lines 55-58); A rotational latency is assigned to each discrete angular region <u>based on a current location of the retrieval element</u> (column 3, lines 15-17)]; **wherein the source head** [the source head represents the "current position" of the read/write element (A rotational latency assigned to each discrete angular region based on a <u>current location</u> of the retrieval element (abstract); The cylinder delta is the number of cylinders from <u>the current position of the read/write element</u> to the start cylinder of command queue (index) (column 8, lines 55-58))] **is able to access the source location** [the longitudinal position measurements are generated based on <u>the current position of the read/write element</u> -- The cylinder delta is the number of cylinders from <u>the current position of the read/write element</u> to the start cylinder of command queue (index) (column 8, lines 55-58); A rotational latency is assigned to each discrete angular region <u>based on a current location of the retrieval element</u> (column 3, lines 15-17)] **but not able to access the target destination** [figure 6B, steps 106, 118 and 120 illustrate the case where the target destination cannot be reached within the criterion from the current position of the read/write element; In other words, some bins may contain only

command addresses that can only be accessed in two revolutions (i.e., cycles) (column 2, lines 28-30)].

As to claim 10, Heath teaches that **the apparatus of claim 8, in which the controller includes a random-access memory configured to contain a queue** [A command queue array is searched for a command that addresses a location within a range of cylinders determined by the number of cylinders in the discrete angular region having the smallest rotational latency (abstract); the command queue is implemented using memory (As a result, the seek ranges may be determined in less time and with lower memory requirements (column 14, lines 12-13)] **of more than 32 disc access commands** [Modern disc drives can have up to 64 or more commands in the command queue (column 1, lines 56-57)] **in which each of the commands includes a target cylinder identifier** [Each disc has a plurality of concentric tracks, ... In addition, each track is further divided into a plurality of sectors. A track cylinder is formed by the radically corresponding tracks on the disc memories. In a disc drive system, a disc rotates at a high speed while the read/write element "flies" over the surface of the rotating disc. The read/write element is positioned over specific areas or sectors of the disc in accordance with commands received from the host compute (column 1, lines 12-22); The seek time is the time required for the read/write element to radically move across or traverse cylinders between the present cylinder over which the read/write element is positioned and the cylinder to be addressed by the particular command (column 1, lines 31-35)], **a target head identifier** [For purposes of sorting the command queue, the command addresses are converted into a cylinder, head and

angular region address. The angular regions provide a common system of measurement for all addresses regardless of recording zone (column 5, lines 10-14)], a**nd a target sector identifier** [Each disc has a plurality of concentric tracks, ... In addition, each track is further divided into a plurality of sectors. A track cylinder is formed by the radically corresponding tracks on the disc memories ... The read/write element is positioned over specific areas or sectors of the disc in accordance with commands received from the host compute (column 1, lines 12-22)].

As to claim 11, it recites substantially the same limitations as in claim 1, and is rejected for the same reasons set forth in the analysis of claim 1. Refer to "As to claim 1" presented earlier in this Office Action for details.

As to claim 12, it recites substantially the same limitations as in claim 1, and is rejected for the same reasons set forth in the analysis of claim 1. Refer to "As to claim 1" presented earlier in this Office Action for details.

As to claim 13, it recites substantially the same limitations as in claim 1, and is rejected for the same reasons set forth in the analysis of claim 1. Refer to "As to claim 1" presented earlier in this Office Action for details.

As to claim 14, it recites substantially the same limitations as in claim 1, and is rejected for the same reasons set forth in the analysis of claim 1. Refer to "As to claim 1" presented earlier in this Office Action for details.

As to claim 15, it recites substantially the same limitations as in claim 1, and is rejected for the same reasons set forth in the analysis of claim 1. Refer to "As to claim 1" presented earlier in this Office Action for details.

As to claim 16, it recites substantially the same limitations as in claim 2, and is rejected for the same reasons set forth in the analysis of claim 2. Refer to "As to claim 2" presented earlier in this Office Action for details.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 5 and 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heath et al. (US 5,570,332, hereinafter referred to as Heath), and in view of Kang et al. (US 6,441,988, hereinafter referred to as Kang).

As to claim 5, Heath teaches **the method of claim 1 in which the selecting step (a) includes a step (a1) of calculating each of the adjusted seek lengths as an arithmetic combination of several terms** [see the equations of calculating the Estimated Seek Time EST(D), column 10, lines 40-60; column 11, lines 1-35; column 12, lines 23 to column 13, line 45], but Heath does not teach that **at least one of the terms being a sinusoidal function of the longitudinal position measurement**.

Kang teaches in the invention "Method and Apparatus for Reducing Acoustic Noise in a Hard Disk Drive" a scheme of moving a transducer (i.e., the read/write head) across a disk surface so that it has an essentially sinusoidal trajectory [abstract; column 5, lines 9-38; note that the position of the transducer x(n) contains a sinusoidal function as shown in equation (8), column 5, line 26].

Kang also teaches that the motivation of moving a transducer by using an essentially sinusoidal trajectory is to reduce high harmonics, to minimize the acoustic noise, to reduce the settling time of the transducer, and to reduce the duration of the seek operation [During the seek routine the controller may move the transducer in accordance with a sinusoidal acceleration trajectory. The sinusoidal trajectory may reduce the high harmonics found in square waveforms of the prior art, and thus minimize the acoustic noise of the head assembly and reduce the settling time of the transducer for reducing the duration of the seek routine (abstract)].

Therefore, it would have been obvious foe one of ordinary skills in the art at the time of Applicants' invention to include a sinusoidal function in the trajectory of the transducer, as demonstrated by Kang, into the existing method disclosed by Heath, because Kang teaches that, by doing so, it will reduce high harmonics, to minimize the acoustic noise, to reduce the settling time of the transducer, and to reduce the duration of the seek operation.

As to claim 17, it recites substantially the same limitations as in claim 5, and is rejected for the same reasons set forth in the analysis of claim 5. Refer to "As to claim 5" presented earlier in this Office Action for details.

As to claim 18, Heath in view of Kang teaches **the method of claim 17, wherein at least another of the terms of the arithmetic combination comprises an exponential function of the destination cylinder** [Kang: equation 14 (col. 6, line 15)].

10. ***Related Prior Art***

The following list of prior art is considered to be pertinent to applicant's invention, but not relied upon for claim analysis conducted above.

- Lamberts, (US 6,272,565), "Method, System, and Program for Recording a Queue of Input/Output (I/O) Commands into Buckets Defining Ranges of Consecutive Sector Numbers in a Storage Medium and Performing Iterations of a Selection Routine to Select and I/O Command to Execute."

Conclusion

11. Claims 1-18 are rejected as explained above.

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sheng-Jen Tsai whose telephone number is 571-272-4244. The examiner can normally be reached on 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Kim can be reached on 571-272-4182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Sheng-Jen Tsai/

Partial Signatory Examiner, Art Unit 2186

March 10, 2008

/Pierre-Michel Bataille/
Primary Examiner, Art Unit 2186